

Future Hydrocarbon Prospectivity of Southern Iraq with the Emphasis on the Mishrif Cenomanian and the Yamama Valanginian Reservoirs*

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Abstract

Early hydrocarbon prospectivity of Iraq during the turn of the twentieth century targeted the numerous anticlinal surface structures in the country or relied on simple magnetic and gravity tools used during the late 1940s to the late 1950s culminating in the discovery of the supergiant and giant fields such as the Kirkuk, Jambur and Bai Hassan in the north and the Zubair and Rumaila in the south. During the early 1970s to the early 1990s huge exploration activities took place covering the entire country with 2D seismic coverage as well as extensive exploration drilling culminating in the discovery of additional supergiant and giant fields such as the West Qurna and the Majnoon fields. The present study utilises some of the results obtained from the regional old 2D seismic coverage of the south as well as the results obtained from the exploration drilling at that time to highlight some of the possible future hydrocarbon prospectivity potential of southern Iraq.

Methodology

Phase I of the study involved the construction of five hand-drawn, regional structure depth maps on top of the main reservoir targets from central and southern Iraq. This involved data analysis from more than 260 regional wells covering the study areas from central to southern Iraq. This would be verified and integrated with data obtained from the regional east-west and north-south 2D seismic transects study covering the entire central and southern Iraq areas.

The top Cretaceous Regional Depth Reservoir Map (C.I. = 25m) was constructed by hand from interpreted regional seismic transect study verified by formation tops from over 260 regional wells. The remaining Regional Reservoir Depth Maps (Top Mishrif, Nahr Umr, Zubair and Yamama) (C.I. = 20m) were also constructed by hand based from the top Cretaceous horizon; using the interval thickness for each reservoir horizon corrected and verified with the data obtained from regional 2D seismic transect study from central and southern Iraq. In addition to the above five regional reservoir maps, two further regional seismic depth maps were also constructed and mapped from the 2D seismic transect study. These are the Lower Fars Regional Seal (Cap Rock) Map (C.I. = 20m) and the top Jurassic Gotnia seismic depth map (C.I. = 20m) as shown in [Figure 1](#).

Phase II of the study involved the construction of several isopach maps for the main reservoir facies units of the Cenomanian Mishrif and the Valanginian Yamama reservoirs. The data for this phase of the study involved reservoir facies analysis from core description and wireline logs from numerous regional wells covering the entire studied areas of central and southern Iraq. Several Mishrif and Yamama isopach units were identified and mapped which are listed and briefly described below.

The Mishrif reservoir units consist of restricted shelf to open shelf with rudists' build-up and basinal facies, which in general can be classified into dense and porous facies as follows:

- Mishrif MA: Dense mud supported
- Mishrif MB: Dense mud supported
- Mishrif MC: Porous with rudist build-up
- Mishrif MD: Porous with rudist build-up

The Yamama reservoir units consist of lagoonal tidal carbonate to open shelf with shallow ramp build-ups as follows:

- Yamama YA: Porous oolitic and pseudo-oolitic
- Yamama YB: Porous pelletal oolitic
- Yamama YC: Porous pelletal oolitic
- Yamama Ya1: Upper Dense mud supported
- Yamama Yb1: Lower Dense mud supported

Results

The five regional hand-drawn contour reservoir depth maps on top of the main regional reservoirs in central and southern Iraq were digitised into ArcGIS project (ArcGIS v.10) and displayed using 3D modelling software (3D Field v.3.7.2.0) as well as structural modelling software (MOVE v. 2013.1) as shown in [Figure 2](#), [Figure 3](#), [Figure 4](#), [Figure 5](#), and [Figure 6](#). The Mishrif and Yamama isopach facies units were also digitised and displayed in ArcGIS project and 3D MOVE software.

The results of this study clearly show that large structural swathed areas outside the known developed supergiant and giant fields of southern and central Iraq are yet to be targeted and drilled. Finally, the carbonate porous facies of the Cenomanian Mishrif and the Valanginian Yamama clearly extend outside the known structural highs of the giant and supergiant developed fields and these should be targeted as possible future stratigraphic prospects in central and southern Iraq.

Summary and Conclusions

The hydrocarbon prospectivity potential of Iraq is enormous which is being proven now by the recently announced big oil and gas field discoveries in the Kurdistan Region. This has been achieved by deploying the latest 3D seismic and drilling techniques. The present study has also shown that by utilising the old 2D seismic data with enhanced 3D modelling software and mapping techniques have revealed large swathed areas of central and southern Iraq with structural highs outside the known developed field areas, which could be targeted as possible future exploration prospects. Regional mapping of the different isopach facies for the Cenomanian Mishrif and the Valanginian Yamama have also shown large areas outside the known field areas that could be considered as possible exploration targets for stratigraphic traps.

Acknowledgements

Every effort has been made to trace rights holders, but if any have been inadvertently overlooked, the authors would be pleased to make the necessary arrangements at the first opportunity. GeoDesign would like to acknowledge that some of the information used in this presentation where presented by the Ministry of Oil - Iraq during conferences and road shows carried out from the late 1990s as well as during the recent licensing rounds and would like to thank the MoO for all the information used in this presentation. Finally, GeoDesign would like to thank various clients who allowed permission to use some of the interpreted results obtained from previous consultations and studies to be used here in this presentation.

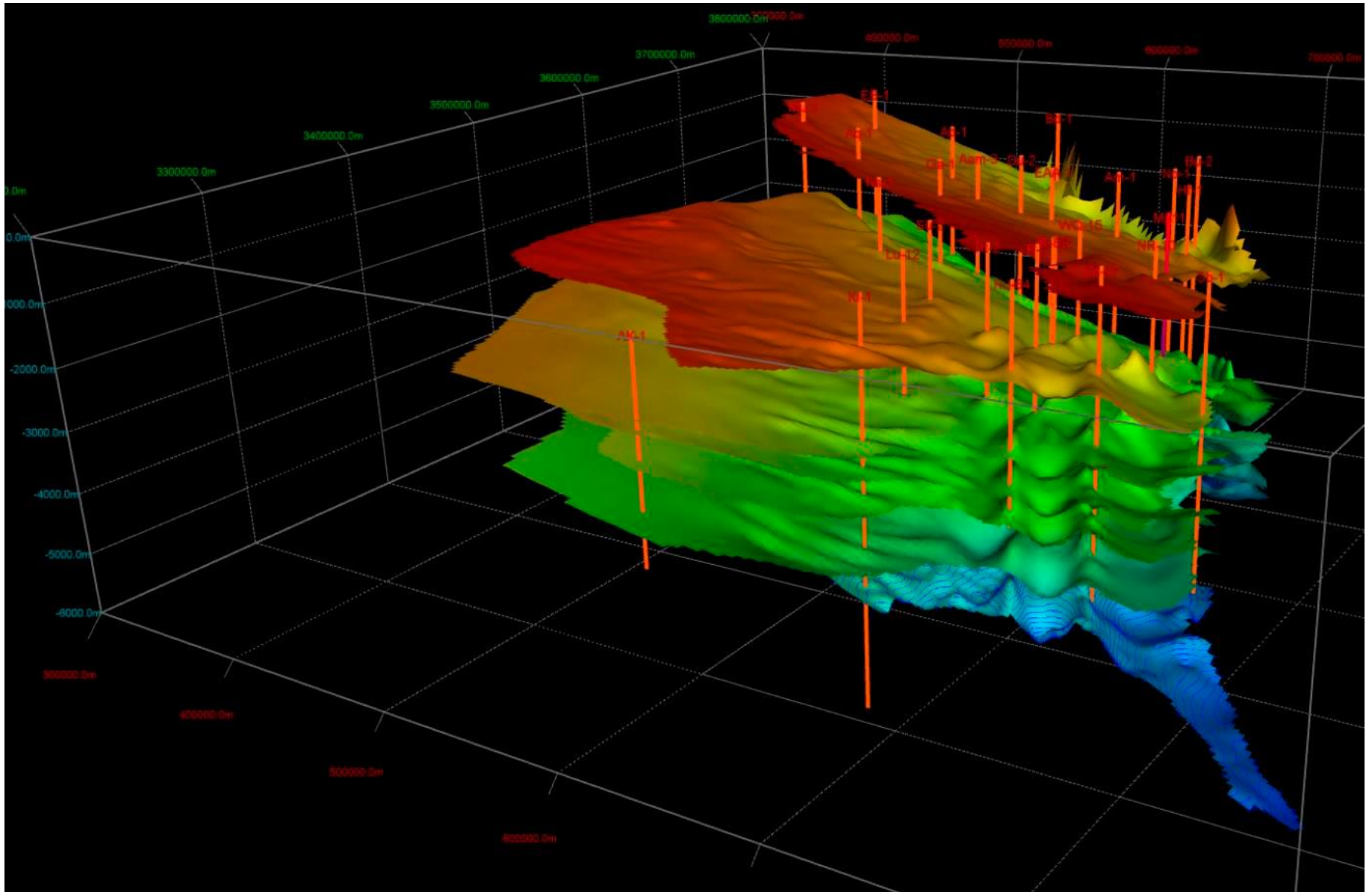


Figure 1. The five regional reservoir depth maps stacked on top of each other; bounded at the top by the Lower Fars (cap rock) horizon and at the base by the top Jurassic Gotnia horizon with some of the key regional wells penetrating the regional reservoir horizons.

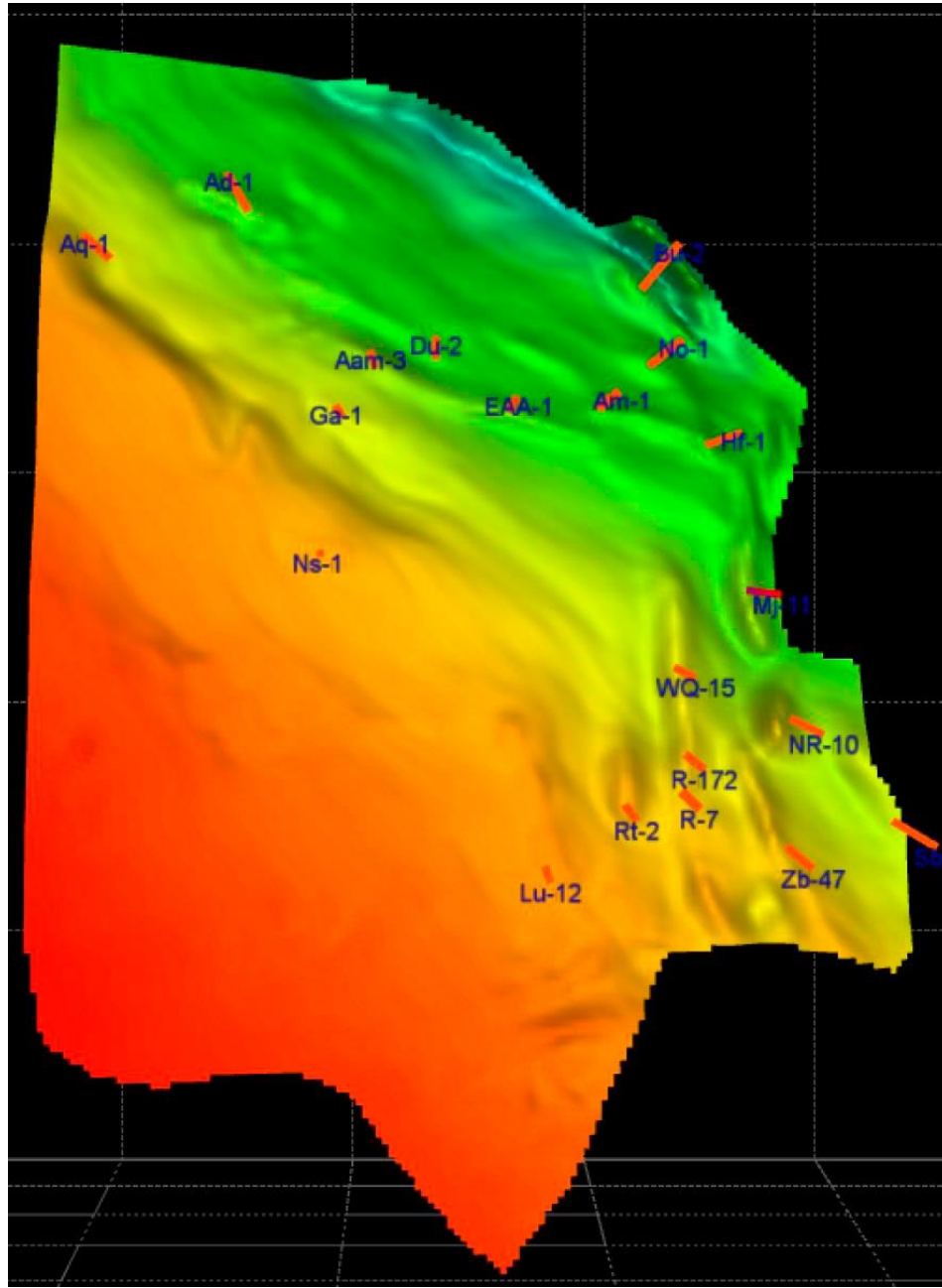


Figure 2. Top Cretaceous structure depth map showing the extent of the structural highs outside the known developed field areas.

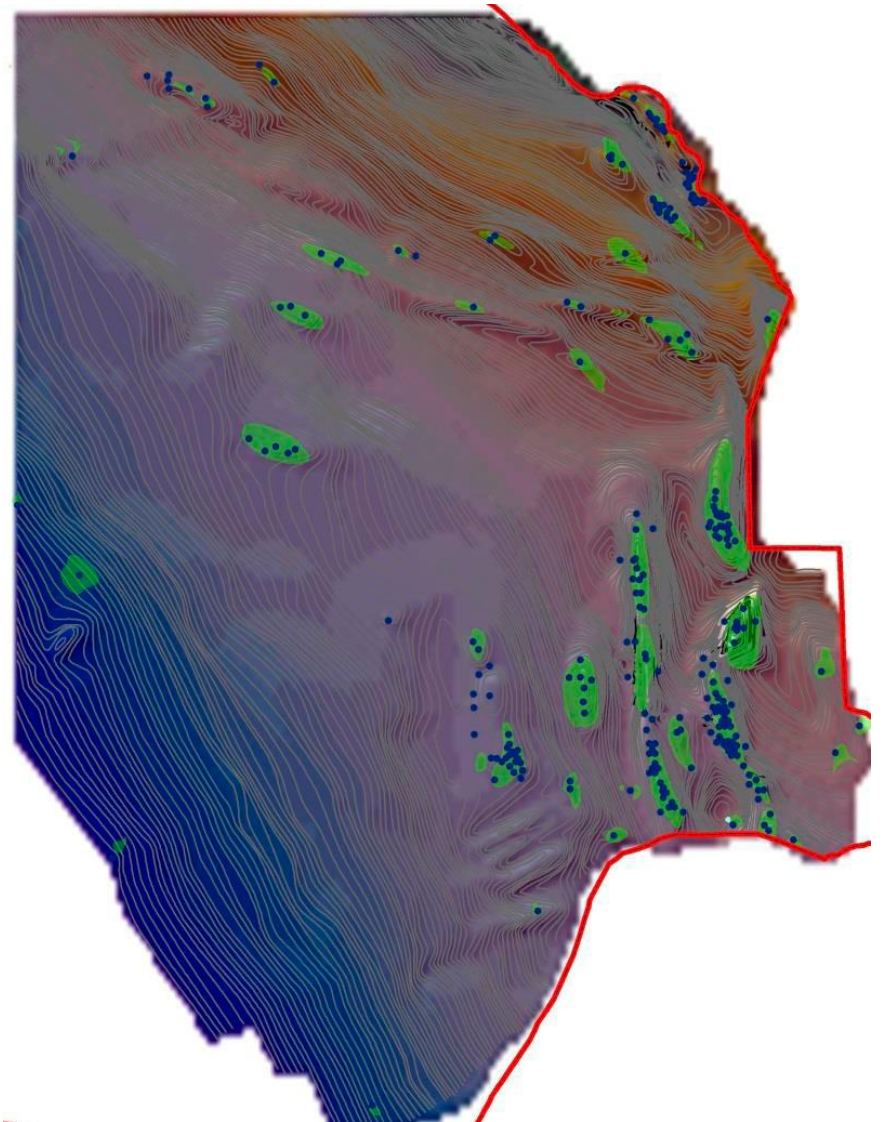
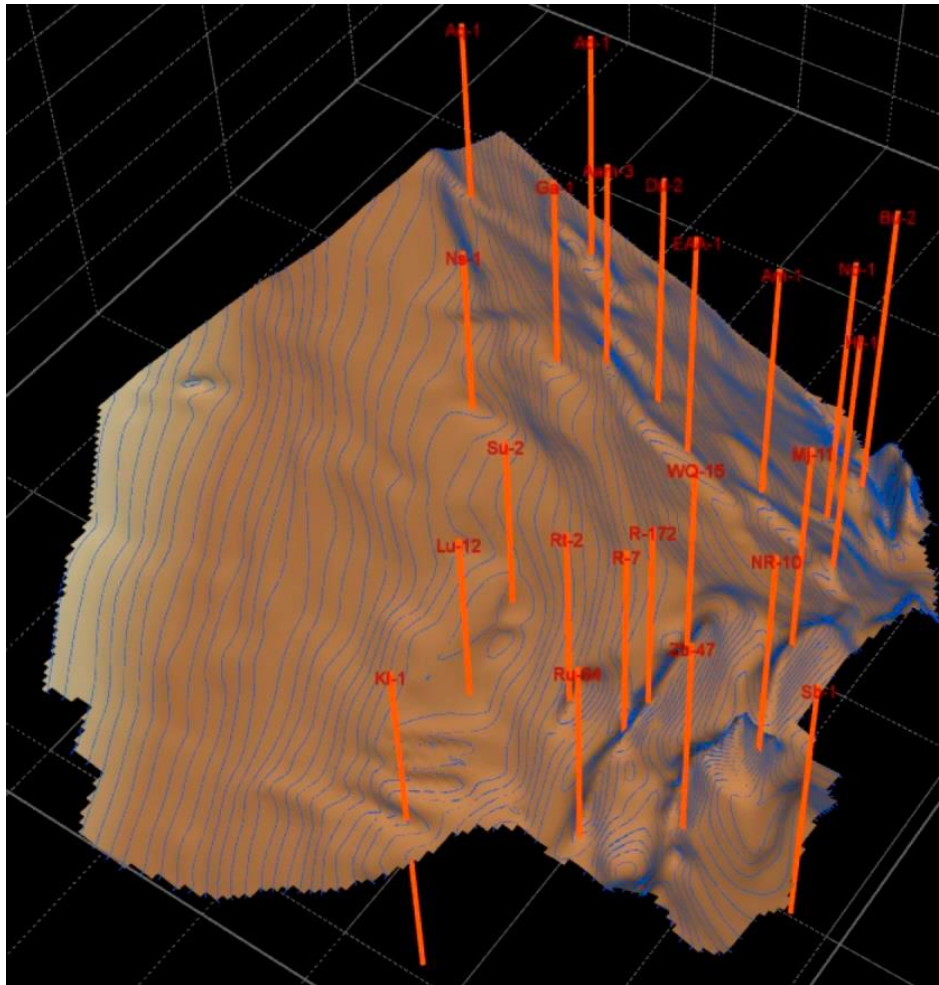


Figure 4. Top Zubair depth map showing the extent of structural highs outside the known field areas as future exploration prospects in central and southern Iraq.

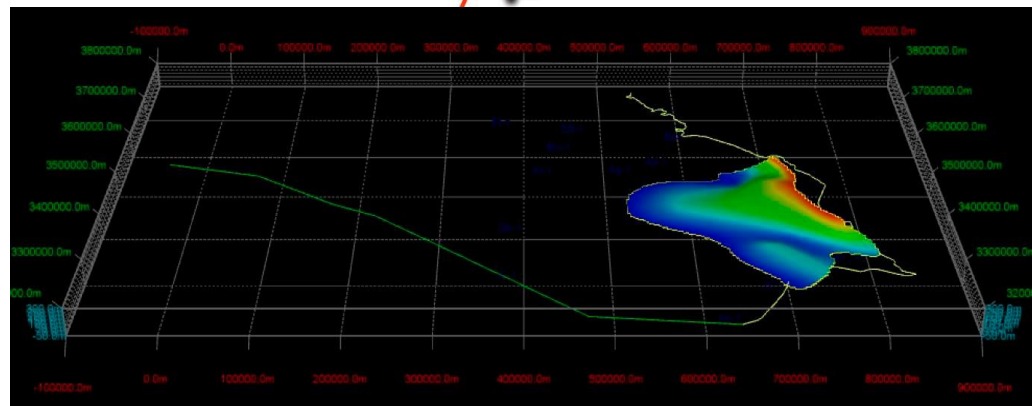
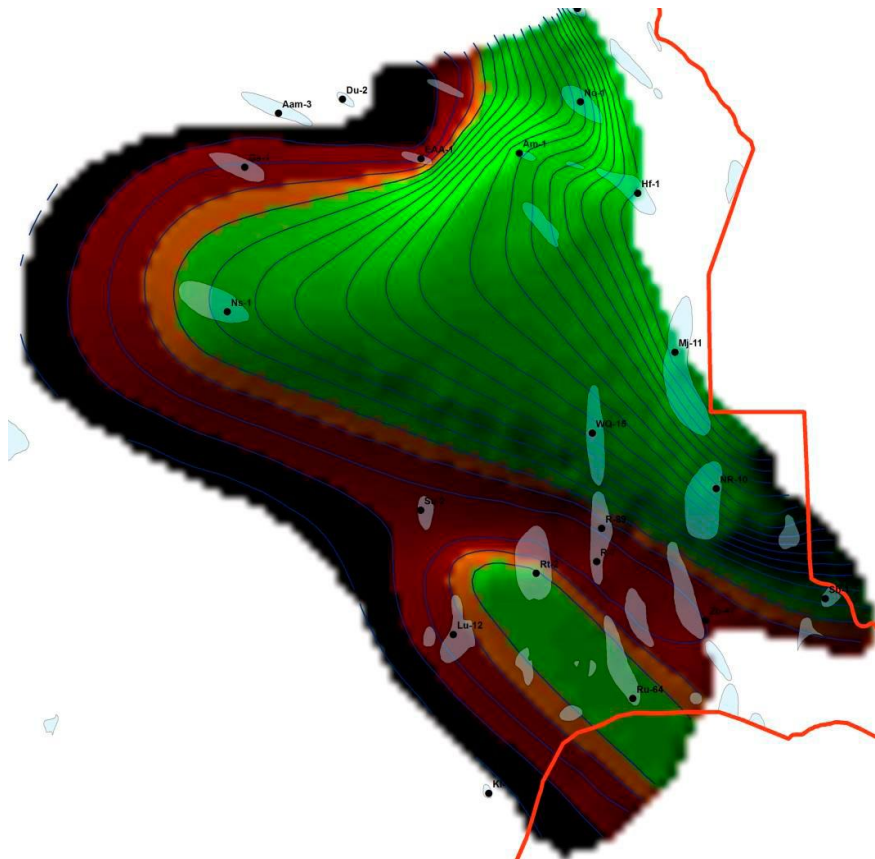


Figure 5. Isopach map of Mishrif MC porous unit showing the extent of this reservoir unit outside the known structural highs of the main developed field areas in the south.

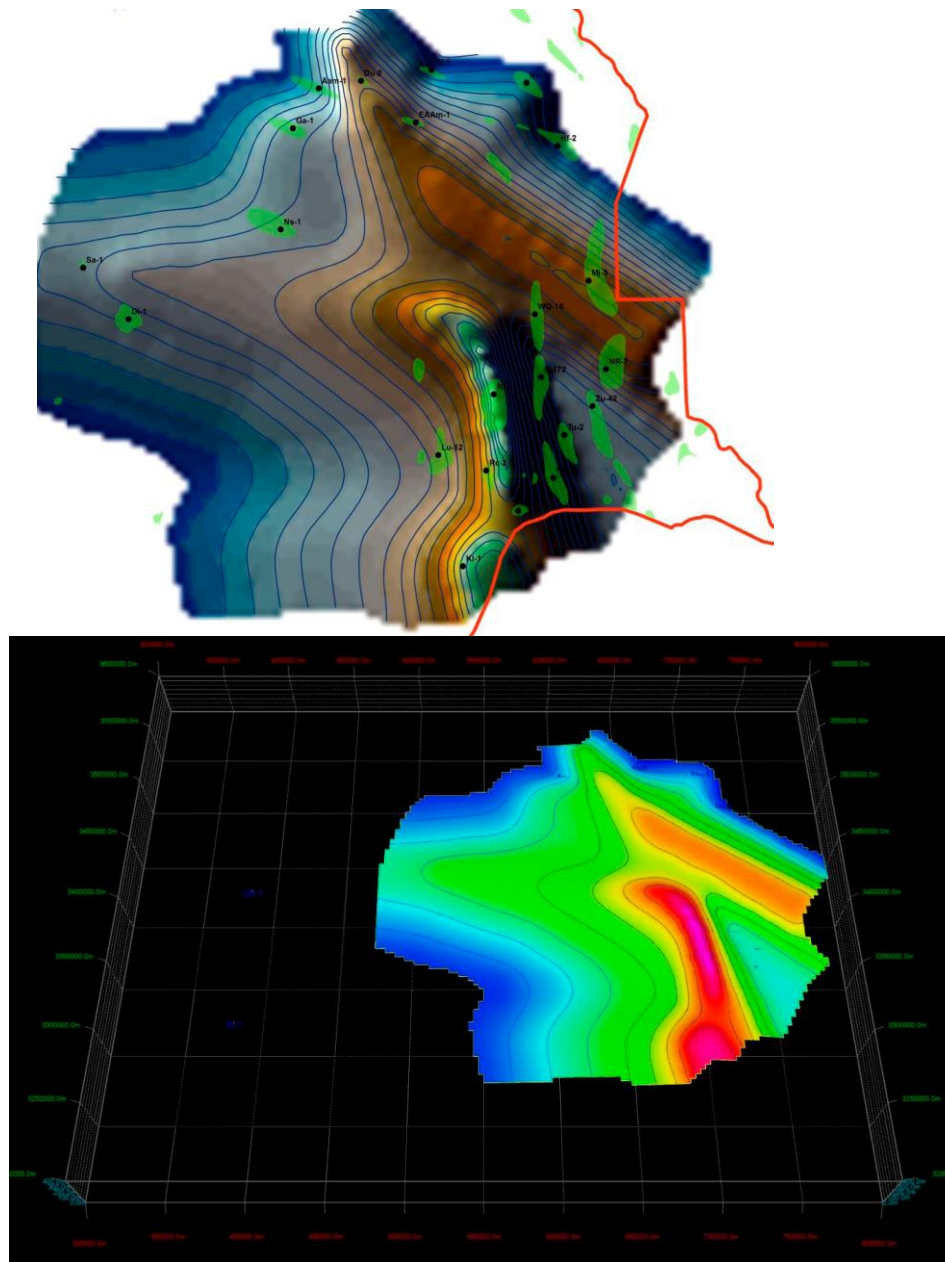


Figure 6. Isopach map of the Yamama reservoir unit YA in southern Iraq showing the extent of the possible future prospectivity potential outside the known field areas.